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# TELESCOPING SHAFT FOR AN UMBRELLA

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# TELESCOPING SHAFT FOR AN UMBRELLA

[Teleskop-Schaft Für einen Schirm]

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A known middle shaft 1, as illustrated in Figures 1-5, has the following elements: A lower tube 11 on which a handle 12 is attached, a middle tube 13 that can slide into and engage with the lower tube 11, an upper tube 14 that can slide into and engage with the middle tube 13, an upper snap in element 15 attached to one upper region of the upper tube 14 in order to secure upper ribs 21 of a rib unit 2 to pivot into the snap 15, and also a slide 16 that is held to and slides on the middle shaft 1, and to which the span ribs 22 of the rib unit 2 are attached in a pivoting manner, which are connected to and pivot with the upper ribs 21 of the rib unit 2 on which a (not illustrated) umbrella fabric is attached. In this manner, an extending middle shaft for an umbrella, such as an automatically opening and closing umbrella, is formed.

The middle tube 13 has a hexagonal cross section, whereby the hexagonal tube has six flat, rectangular sides, with a bottom cylindrical region 131 that is formed at the bottom region of the middle tube and extends downward at a reduced cross section, from a lower hexagonal regional 132 of hexagonal cross section. It also has an upper hexagonal region 133 formed on an upper region of the middle tube 13, and also a top cylindrical region 134 that extends upward with an enlarged cross section starting from the upper, hexagonal region 133. The bottom, cylindrical region 131 can slide into and engage with a top hexagonal region 112 which extends upward with enlarged cross section starting from an upper, cylindrical region 111 of the lower tube 11.

The upper tube 14 has a bottom hexagonal tube region 141 that extends downward with a reduced cross section, starting at a lower cylindrical tube region 142, and can slide into and engage with the upper hexagonal tube region 133 of the middle tube 13.

The upper tube 14, the middle tube 13 and the lower tube 11 can contract or extend in a telescoping manner when opening or closing the umbrella.

However, since the tube is designed in a hexagonal shape and consists of six flat, rectangular sides, the load can be concentrated on each edge region between two neighboring sides of the hexagonal tube, so that the latter can be easily deformed or damaged at the edge regions.

Therefore the invention is based on the problem of creating an extendable umbrella shaft that avoids this disadvantage and that is more stable and strong than known umbrella shafts.

The invention solves this problem with the properties of Claim 1.

The umbrella shaft according to the invention has a lower tube, a middle tube that slides with and can be articulated on the lower tube, and an upper tube that slides with and can be articulated on the middle tube, whereby each tube has a polygonal cross section and consists of a number of arc-shaped rectangular sides. Each arc-shaped side is bulged inward in the direction of the longitudinal axis of the shaft in order to increase the stability and strength of the shaft tube of the umbrella.

The invention will be explained in greater detail below with reference to the figures. The illustrations show:

Figure 1: A representation of a known, extendable middle shaft of an umbrella;

Figure 2: A cross section along the line 2-2 according to Figure 1;

Figure 3: A cross section along the line 3-3 according to Figure 1;

Figure 4: A cross section along the line 4-4 according to Figure 1;

Figure 5: A cross section along the line 5-5 according to Figure 1;

Figure 6: A representation of an extendable umbrella shaft middle according to the present invention;

Figure 7: A cross section along the line 7-7 according to Figure 6;

Figure 8: A cross section along the line 8-8 according to Figure 6;

Figure 9: A cross section along the line 9-9 according to Figure 6;

Figure 10: A cross section along the line 10-10 according to Figure 6;

Figure 11: A partial view of the longitudinal cross section along the line 11-11 according to Figure 6;

Figure 12: A partial view of the longitudinal cross section along the line 12-12 according to Figure 6;

Figure 13: A representation of the shaping process of an arc-shaped side with little curvature of the arc of the hexagonal tube according to the present invention;

Figure 14: The formation of an arc-shaped side with greater curvature of the arc of the hexagonal tube according to the present invention;

Figure 15: A representation of a region of sliding contact of the arc-shaped, rectangular sides of the hexagonal tubes according to the present invention, in comparison to the flat sides of the known shaft; and

Figure 16: A representation of a reinforced, thickened region of the edge region of the hexagonal tube according to the present invention, in comparison to the known, flat hexagonal tube without reinforced, thickened region.

As is illustrated in Figures 6-12, an extendable shaft 1 according to the present invention has the following elements: A lower tube 11 on which a handle 12 is attached, a middle tube 13 that can slide into and engage with the lower tube 11, an upper tube 14 that can slide into and engage with the middle tube 13, an upper snap in element 15 attached to one upper region of the upper tube 14 in order to secure upper ribs 21 of a rib unit 2 to pivot into the snap 15, and also a slide 16 that is held to and slides on the middle shaft 1, and to which the span ribs 22 are attached in a pivoting manner, which are connected to and pivot with the upper ribs 21 of the rib unit 2 on which a (not illustrated) umbrella fabric is attached, so that a telescoping middle shaft is formed for an automatically opening and closing umbrella, or for other umbrellas. The shaft 1 has a longitudinal axis 10 that is defined by the midpoints of the cross sections of the tubes 11, 13 and 14.

The middle tube 13 has a hexagonal cross section, and the hexagonal tube has six arc-shaped, rectangular sides 130, and each rectangular side 130 is curved inward in the direction of the longitudinal axis 10. On the tube 13 there is a bottom cylindrical tube region 131 that is formed at a bottom region of the middle tube 13 and that extends downward with a reduced cross section from a lower, hexagonal tube region 132 of hexagonal cross section. At the upper region of the middle tube 13 an upper hexagonal tube region 133 is formed. The tube 13 has a top cylindrical tube region 134 that extends upward with enlarged cross section, starting at the upper hexagonal tube region 133. The lowest cylindrical tube region 131 can slide along and engage with a top hexagonal tube region 112 that extends upward with an enlarged cross section, starting at a top cylindrical tube region 111 of the lower tube 11.

The upper tube 14 has a bottom hexagonal tube region 141, that extends downward with reduced cross section, starting at a lower cylindrical tube region 142 of the upper tube, and can slide on and engage with the upper hexagonal tube region 133 of the middle tube 13, whereby the bottom hexagonal tube region 141 consists of six arc-shaped, rectangular sides 140 that define the hexagonal tube region 141, whereby each rectangular side 140 is curved inward with respect to the longitudinal axis 10 of the shaft 1.

The upper tube 14, the middle tube 13 and the lower tube 11 will extend or retract telescopically when closing or opening the umbrella.

The lower tube 11 has an upper, cylindrical tube region 111 that is formed on one upper region of the lower tube 11, and also a top hexagonal tube region 112 that extends upward with enlarged cross section, from the upper cylindrical tube region 111, whereby the top hexagonal tube region 112 consists of six curve-shaped, rectangular sides 110 that define the hexagonal tube region 112, whereby each rectangular side 110 is curved inward toward the longitudinal axis 10 of the shaft 1.

Every two arc-shaped, rectangular sides 130 or 140 or 110 of the hexagonal tubes 13, 14, 11 have a reinforced, thickened region Rf that is formed at the edge region of two neighboring, arc-shaped, rectangular sides, such as, for example, two sides 110 of the embodiment according to Figure 16, in order to increase the stability in the edge region of the hexagonal shaped tubes and thus to prevent any deformation due to a concentration of load in the edge region. The thickness of the reinforcing region Rf is in a range of 1.2T to 1.5T, where T is the thickness of the tube 13, 11, 14. Since the two neighboring sides are curved inward, the angle of the edge region of the two neighboring sides is reduced and can be easily thickened and reinforced by the thickening region Rf.

The present invention creates an umbrella in which a greater region of sliding contact is provided between two sliding tubes that can be engaged with each other, such as, for instance, between the lower and the middle tube 11, 13, or between the upper and the middle tube 14, 13, as is illustrated specifically according to the following mathematic analysis and in Figures 13-15.

As is illustrated in Figure 13, every arc-shaped, rectangular side 130 of the tube 13 with a base length $S_1$ from two opposing end points P, P of a flat, rectangular side--designated as the cord $L_1$ here--is curved inward toward the axis 10. The following parameters are evident in Figure 13:

$H_1$ - the vertical that extends perpendicular from the cord $L_1$ to the base $S_1$ and intersects the base $S_1$ at a point of intersection $X_1$ which represents the midpoint of the base $S_1$.

$A_1$ - the acute angle defined between one half cord ½ $L_1$ and a side L' of a triangle between the point P and the point of intersection $X_1$ of the vertical $H_1$.

$C_1$ - the midpoint angle enclosed between two radii $R_1$, $R_1$ around the midpoint $P_1$ of the base $S_1$.

$D_1$ - the distance between the midpoint $P_1$ and the cord $L_1$.

In addition, several formulas are defined:

$H_1 = L_1/2 \text{ X } \tan A_1$

$B_1 = 90° - A_1$, where $B_1$ is a complementary angle to $A_1$;

$C_1 = 180° - 2 \text{ X } (90° - A_1) = 2A_1$

$D_1 = L_1/2 \text{ X } \text{Cot}C_1 = L_1/2 \text{ Cot } (2A_1)$

$R_1 = H_1 + D_1$

Consequently, the base length $S_1$ can be defined by a radius $R_1$ around the midpoint $P_1$ that intersects the two points P, P, that are located at one edge region between two neighboring sides 130 of the tube 13.

As is illustrated in Figure 14, for a larger depth (curvature) of the base $S_2$, the following relationships are found:

$H_2 = L_2/2 \text{ X } \tan A_2$

$D_2 = L_2/2 \text{ Cot } (2A_2)$

$R_2 = H_2 + D_2$.

According to the present invention, therefore, in the latter case a curve-shaped side 130 with deeper concave shape is formed.

The acute angles $A_1$, $A_2$ between the cords $L_1$, $L_2$ and the triangular sides L' between the vertical point of intersection $X_1$, $X_2$ and the point P between two neighboring, arc-shaped, rectangular sides 130 (or 110, 140) reside in a range from 5° to 30°, preferably in a range from 8.5° to 15°, however, the present invention not restricted to this range.

The vertical $H_1$, $H_2$ has a length that is proportional to one length of the cord $L_1$, $L_2$ in a ratio of 1/20 to 1/5.

Since the arc length S is always longer than the cord L (S > L), as is illustrated in Figure 15, the contact region S X H between two tubes sliding in contact with each other with a height H (like tubes 13 and 11, for example) and with a concave, hexagonal shape according to the invention is greater than the contact region L X H of the flat, hexagonal shape of a known umbrella, like that illustrated in Figures 1-5 (S X H > L X H).

Consequently the present invention is superior to the known umbrella shaft illustrated in Figure 1 and has the following advantages:

1. A reinforced, thickening region Rf is formed at the edge region between two neighboring sides of the tube in order to enhance the stability or strength at the edge regions of the polygonal-shaped tube, and thus to prevent any deformation or damage to the tube due to a concentration of load in the edge regions of the tube.

2. Due to the present invention, a greater sliding contact surface can be obtained between two sliding tubes that engage with each other, in order to stabilize the tubes, when these tubes are pulled apart telescopically.

The present invention can be modified without deviating from the essence and the scope of the invention. The hexagonal shape of the tubes can also be changed into other polygonal shapes and is not restricted by the present invention. Likewise, the number of tubes is not limited in this invention.

Claims

1. Telescoping shaft for an umbrella, consisting of at least a first, inner tube with at least one region with a polygonal cross section, which can slide into and engage with at least one region with a polygonal cross section of a second, outer tube and can be extended telescopically in the longitudinal axis of the shaft, whereby the outer cross section of the first, inner tube corresponds essentially to the inner cross section of the second, outer tube,

characterized in that

each side wall (110, 130, 140) of the region (133, 141'; 132, 112) with polygonal cross section of the first and second tube (11, 13, 14) is curved inward toward the longitudinal axis.

2. Telescoping shaft according to Claim 1, characterized in that the cross section of the side walls (110, 130, 140) define a circular arc (S) that has a height (H) in the middle (X) between the end points (P) of the cord (L) connecting the end points (P), which has a ratio of 1/20 to 1/5 to the length of the cord (L).

3. Telescoping shaft according to Claim 1 or 2, characterized in that in the cross section of the side walls (110, 130, 140) the acute angle between the cord (L) and one triangle side (L'), that runs from one end point (P) to the middle (X) of the circular arc (S), is in a range from 5°-30°, preferably in a range from 8.5°-15°.

4. Telescoping shaft according to one of the preceding Claims, characterized in that the edge regions (Rf) of two neighboring side walls (110, 130, 140) are thickened as reinforcement.

5. Telescoping shaft according to Claim 4, characterized in that the edge regions (Rf) have a thickness of 1.2T to 1.5T, where T is the normal thickness of the side walls (110, 130, 140).

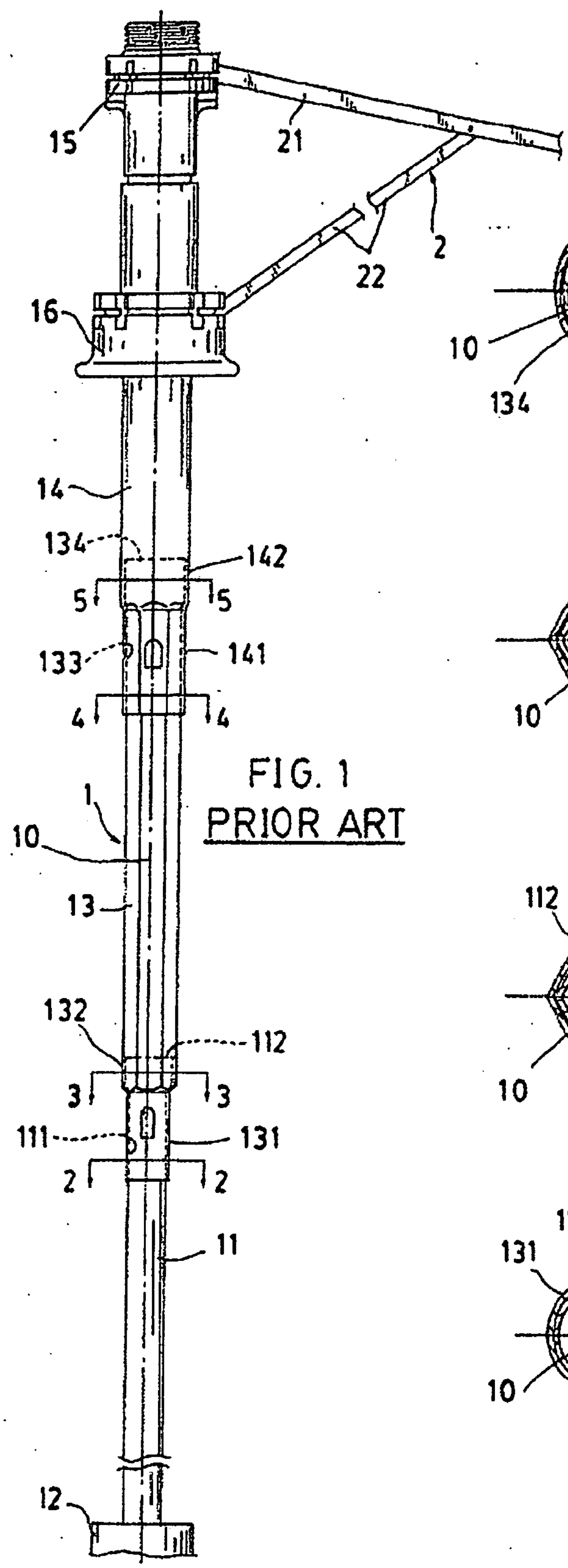


FIG. 1
PRIOR ART

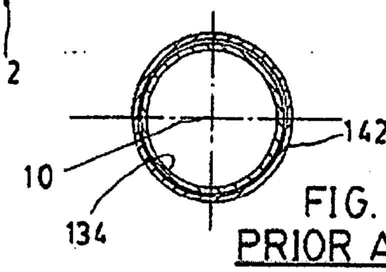


FIG. 5
PRIOR ART

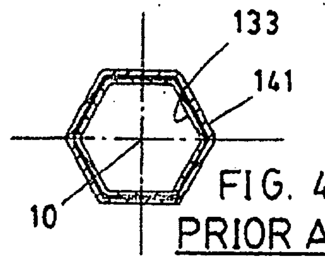


FIG. 4
PRIOR ART

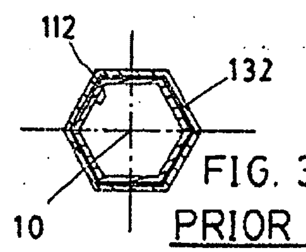


FIG. 3
PRIOR ART

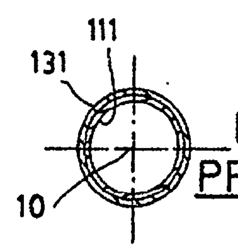


FIG. 2
PRIOR ART

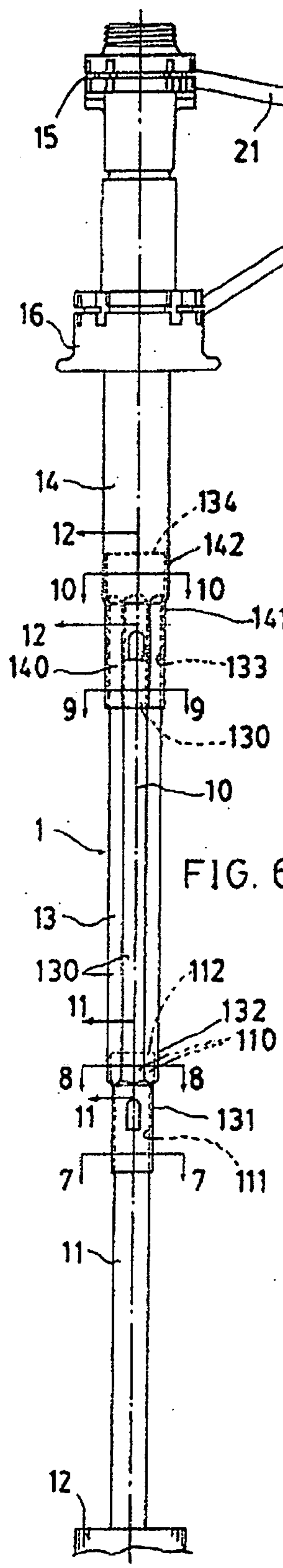


FIG. 6

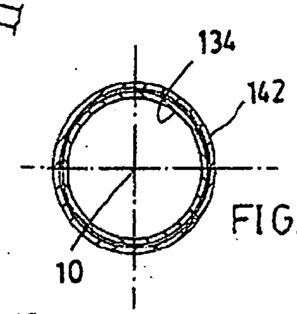


FIG. 10

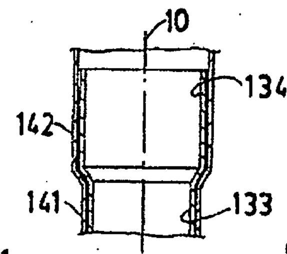


FIG. 12

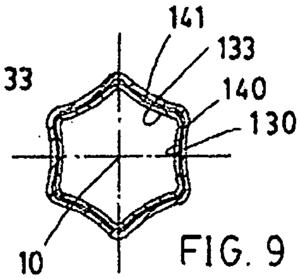


FIG. 9

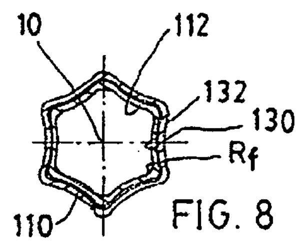


FIG. 8

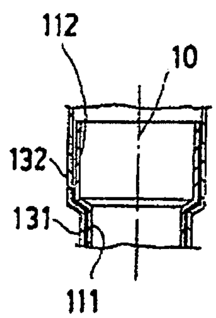


FIG. 11

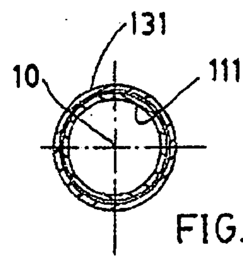


FIG. 7

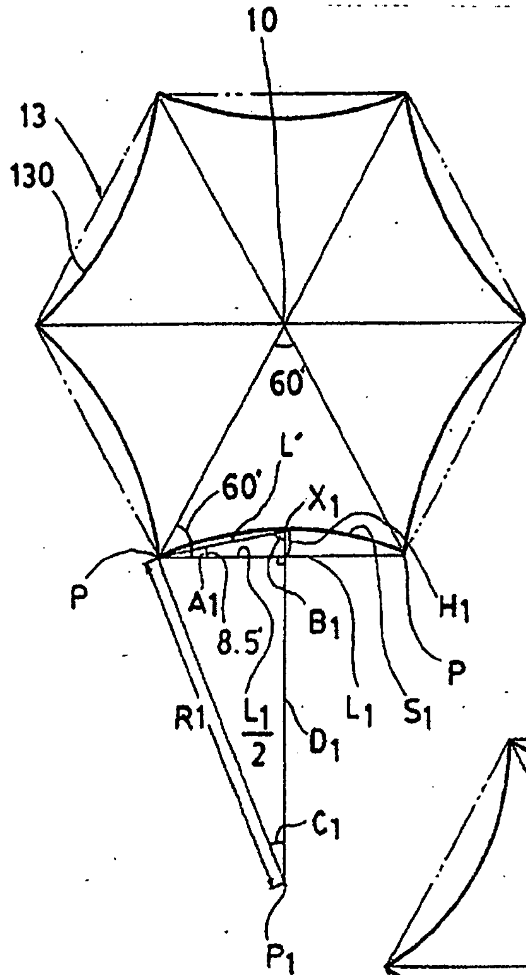
10
13
130
60°
L'
60°
X1
P
A1
8.5°
B1
H1
P
L1/2
L1
S1
R1
D1
C1
P1

FIG. 13

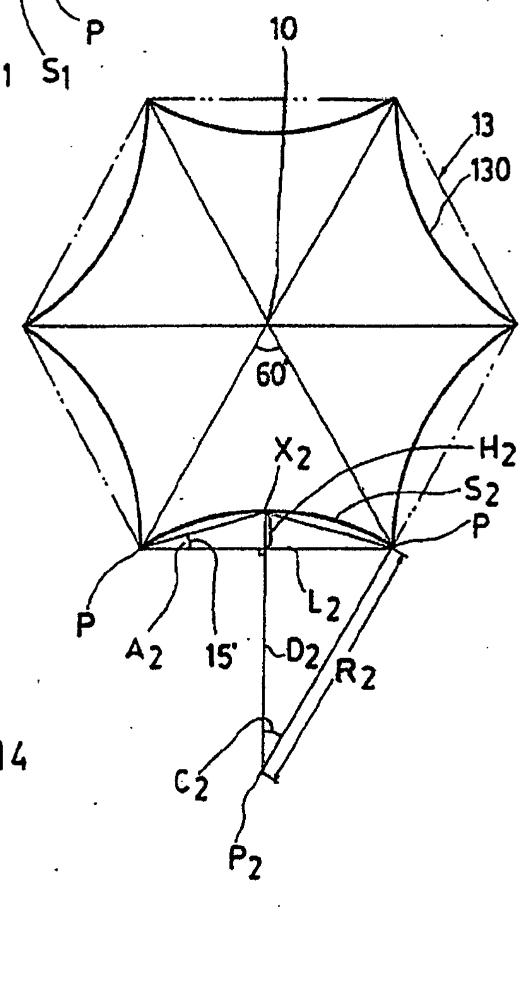
10
13
130
60°
X2
H2
S2
P
P
A2
15°
L2
D2
R2
C2
P2

FIG. 14

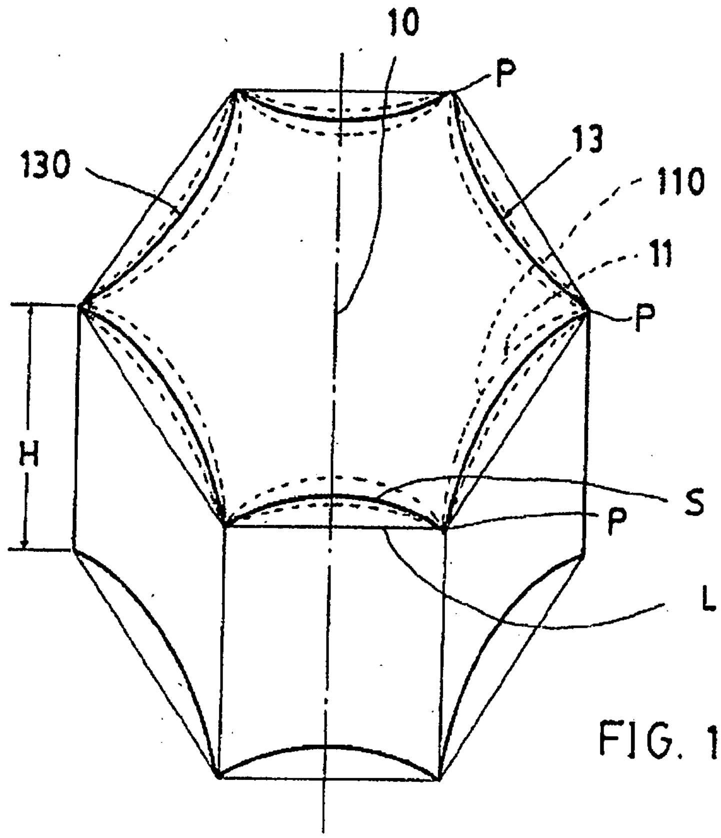


FIG. 15

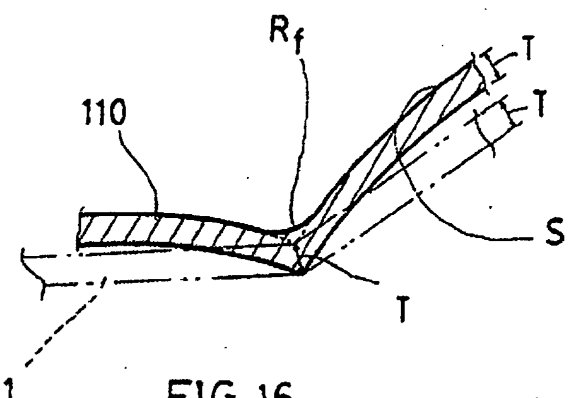


FIG. 16